

To our customers,

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## Old Company Name in Catalogs and Other Documents

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On April 1<sup>st</sup>, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: <http://www.renesas.com>

April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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(Note 2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

**HIGH-FREQUENCY LOW-NOISE AMPLIFIER  
NPN SILICON EPITAXIAL TWIN TRANSISTOR  
(WITH BUILT-IN 6-PIN 2 × 2SC4226) THIN-TYPE SMALL MINI MOLD**

The  $\mu$ PA821TF has 2 built-in low-voltage transistors which are designed for low-noise amplification in the VHF to UHF band.

**FEATURES**

- Low-noise  
NF= 1.2 dB/TYP. @ f = 1 GHz, V<sub>CE</sub> = 3V, I<sub>c</sub> = 7mA
- High gain  
IS<sub>21eI</sub><sup>2</sup> = 9.0 dB/TYP. @ f = 1 GHz, V<sub>CE</sub> = 3V, I<sub>c</sub> = 7mA
- 6-pin thin-type small mini mold package adopted
- Built-in 2 transistors (2 × 2SC4226)

**ORDERING INFORMATION**

Part Number	Quantity	Packing Style
$\mu$ PA821TF	Loose products (50 pcs)	Embossed tape 8 mm wide. Pin 6 (Q1 Base), Pin 5 (Q2 Emitter), Pin 4 (Q2 Base) face to perforation side of the tape.
$\mu$ PA821TF-T1	Taping products (3 kpcs/reel)	

**Remark** If you require an evaluation sample, please contact an NEC Sales Representative (unit sample quantity is 50 pcs).

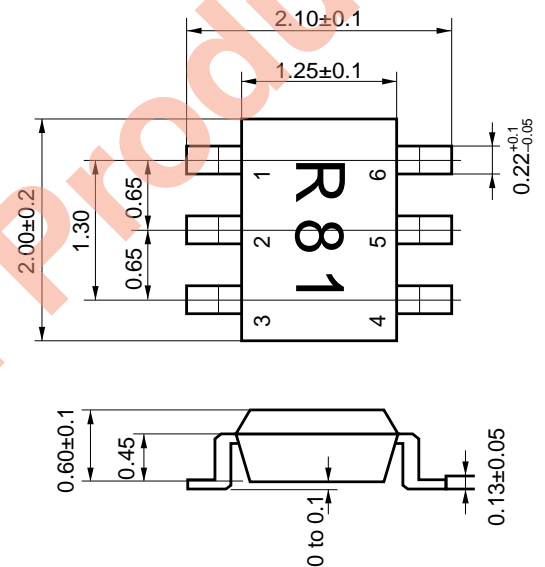
**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C)**

Parameter	Symbol	Rating	Unit
Collector to Base Voltage	V <sub>CB0</sub>	20	V
Collector to Emitter Voltage	V <sub>CE0</sub>	12	V
Emitter to Base Voltage	V <sub>EB0</sub>	3	V
Collector Current	I <sub>c</sub>	100	mA
Total Power Dissipation	P <sub>T</sub>	150 in 1 element 200 in 2 elements <sup>Note</sup>	mW
Junction Temperature	T <sub>j</sub>	150	°C
Storage Temperature	T <sub>stg</sub>	-65 to 150	°C

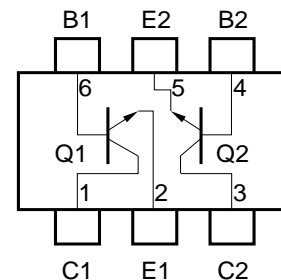
**Note** 110 mW must not be exceeded for 1 element.

**Caution is required concerning excess input, such as from static electricity, due to the high-precision fabrication processes used for this device.**

**PACKAGE DRAWINGS (Unit: mm)**



**PIN CONFIGURATION (Top View)**



**PIN CONNECTIONS**

- |                   |                 |
|-------------------|-----------------|
| 1. Collector (Q1) | 4. Base (Q2)    |
| 2. Emitter (Q1)   | 5. Emitter (Q2) |
| 3. Collector (Q2) | 6. Base (Q1)    |

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

Parameter	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Collector Cutoff Current	I <sub>CB0</sub>	V <sub>CB</sub> = 10 V, I <sub>E</sub> = 0			1.0	μA
Emitter Cutoff Current	I <sub>EB0</sub>	V <sub>EB</sub> = 1 V, I <sub>C</sub> = 0			1.0	μA
DC Current Gain	h <sub>FE</sub>	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 7 mA <sup>Note 1</sup>	70		140	
Gain Bandwidth Product	f <sub>T</sub>	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 7 mA	3.0	4.5		GHz
Feedback Capacitance	C <sub>re</sub>	V <sub>CB</sub> = 3 V, I <sub>E</sub> = 0, f = 1 MHz <sup>Note 2</sup>		0.7	1.5	pF
Insertion Power Gain	S <sub>21e</sub>   <sup>2</sup>	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 7 mA, f = 1 GHz	7	9		dB
Noise Figure	NF	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 7 mA, f = 1 GHz		1.2	2.5	dB
h <sub>FE</sub> Ratio	h <sub>FE1</sub> /h <sub>FE2</sub>	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 7 mA h <sub>FE1</sub> = Smaller h <sub>FE</sub> value among Q1 and Q2 h <sub>FE2</sub> = Larger h <sub>FE</sub> value among Q1 and Q2	0.85			

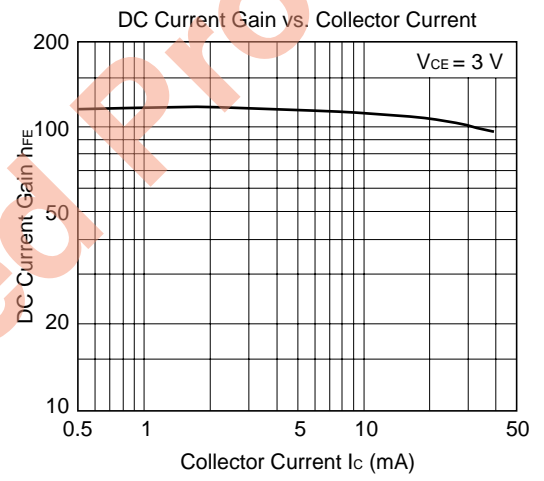
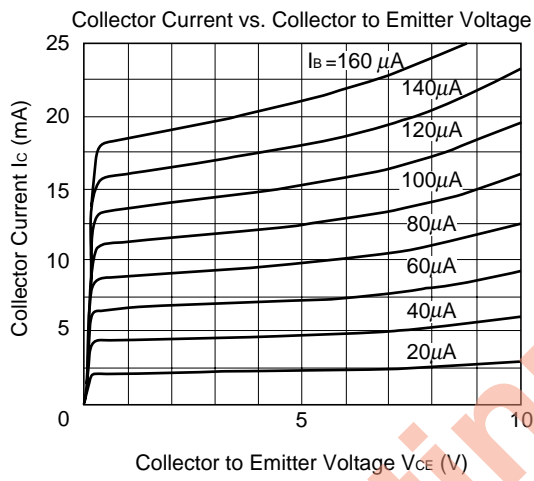
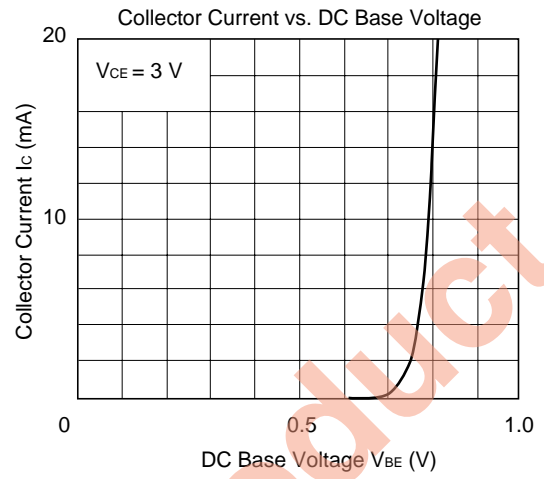
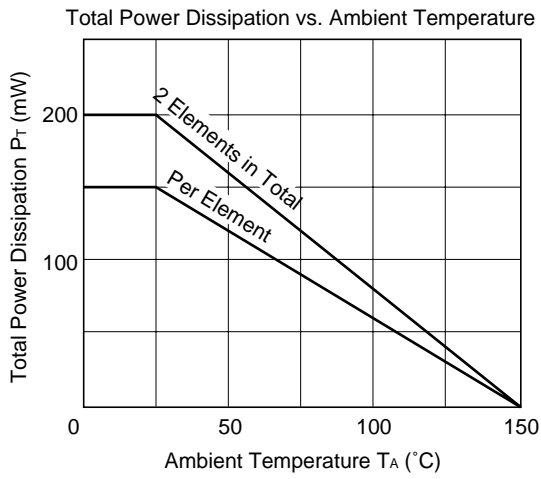
**Notes 1.** Pulse measurement P<sub>w</sub> ≤ 350 μs, Duty cycle ≤ 2 %

**2.** Capacitance between collector and base measured with a capacitance meter (auto-balancing bridge method). Emitter should be connected to the guard pin of capacitance meter.

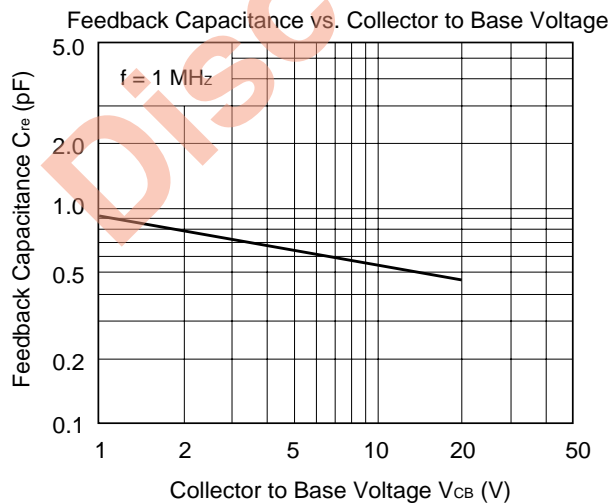
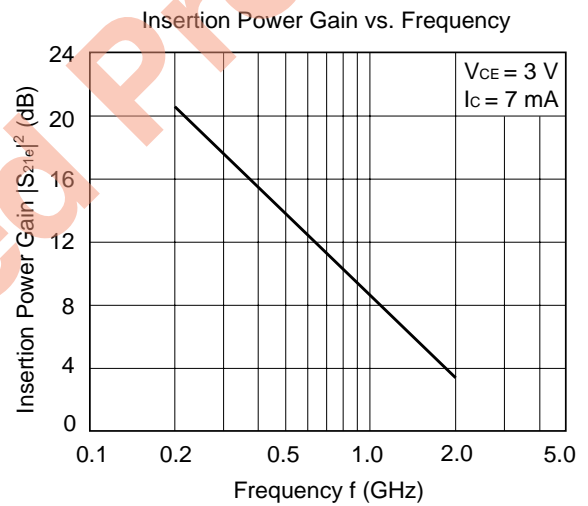
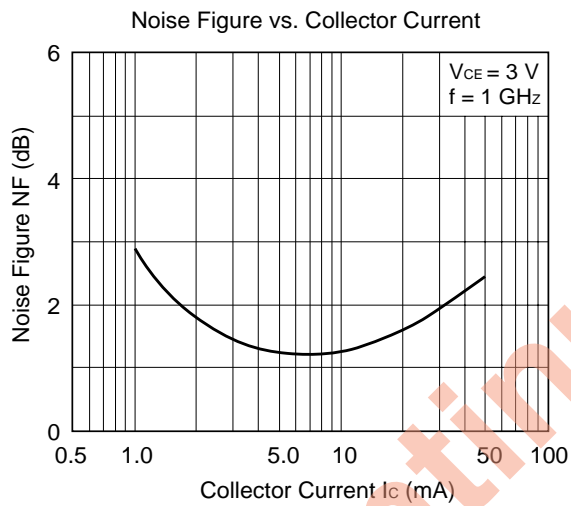
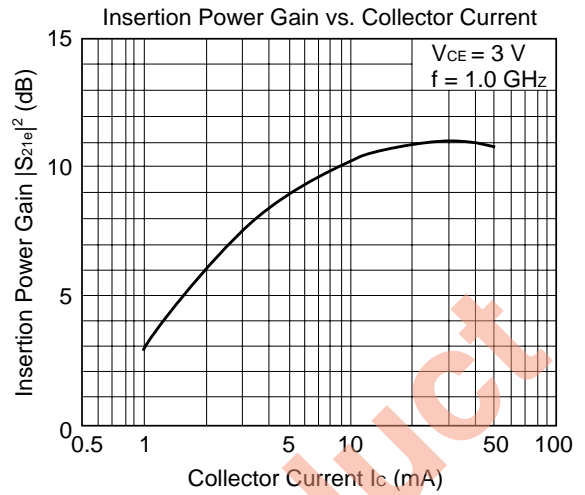
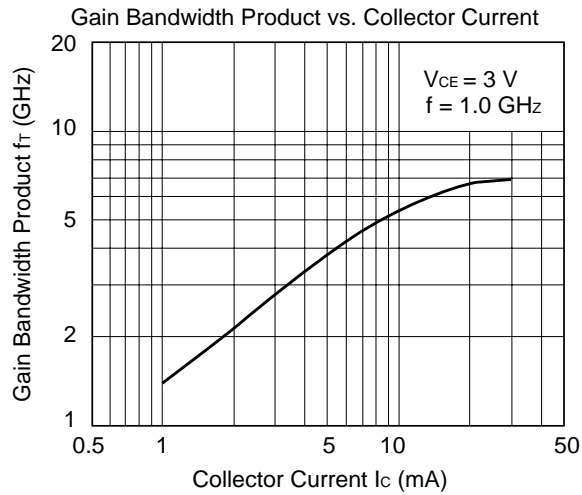
**h<sub>FE</sub> CLASSIFICATION**

Rank	FB
Marking	R81
h <sub>FE</sub> value	70 to 140

TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )



Discontinued



**S PARAMETER Q1**

$V_{CE} = 3\text{ V}$ ,  $I_c = 1\text{ mA}$ ,  $Z_0 = 50\ \Omega$

FREQUENCY GHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
.10	.97	-20.45	2.38	162.85	.04	76.56	.98	-8.59
.20	.94	-40.17	2.31	148.19	.08	63.82	.94	-16.05
.30	.90	-59.57	2.25	135.26	.11	52.97	.89	-22.20
.40	.86	-77.29	2.10	123.99	.13	43.63	.83	-27.30
.50	.82	-94.54	2.03	113.53	.15	36.13	.78	-31.16
.60	.79	-110.15	1.92	104.19	.16	29.28	.74	-34.67
.70	.76	-124.06	1.80	95.54	.16	23.65	.70	-37.55
.80	.74	-136.61	1.69	87.82	.16	19.18	.67	-40.06
.90	.72	-148.19	1.59	80.80	.16	15.47	.65	-42.54
1.00	.71	-158.16	1.48	74.49	.16	12.65	.64	-44.88
1.10	.71	-167.38	1.39	68.76	.15	10.12	.62	-47.25
1.20	.70	-175.72	1.30	63.28	.15	8.37	.61	-49.79
1.30	.71	176.48	1.22	58.43	.14	7.41	.60	-52.21
1.40	.71	169.61	1.15	53.77	.13	7.31	.59	-54.99
1.50	.71	162.88	1.09	49.18	.13	7.58	.59	-57.73
1.60	.72	157.03	1.03	45.04	.12	9.20	.58	-61.04
1.70	.72	151.31	.97	41.14	.12	11.56	.58	-64.34
1.80	.73	146.29	.92	37.65	.11	14.82	.58	-67.77
1.90	.74	141.40	.87	34.21	.11	18.79	.57	-71.13
2.00	.75	136.95	.83	31.08	.11	23.61	.57	-74.83
2.10	.75	132.61	.79	27.91	.11	28.60	.57	-78.77
2.20	.76	128.64	.76	25.12	.11	33.65	.57	-82.60
2.30	.77	124.97	.72	22.56	.12	38.01	.57	-86.85
2.40	.77	121.29	.69	20.26	.12	41.76	.57	-90.91
2.50	.78	117.97	.66	18.15	.13	45.08	.57	-95.23
2.60	.79	114.71	.63	16.20	.14	47.62	.57	-99.78
2.70	.79	111.76	.60	14.55	.15	49.09	.57	-104.24
2.80	.80	108.85	.58	12.80	.16	49.98	.58	-109.00
2.90	.81	106.05	.56	11.46	.18	50.29	.58	-113.69
3.00	.81	103.52	.54	10.02	.19	50.48	.58	-118.13

Discontinued Product

**S PARAMETER Q1**

V<sub>CE</sub> = 3 V, I<sub>c</sub> = 3 mA, Z<sub>0</sub> = 50 Ω

FREQUENCY GHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
.10	.90	-29.42	6.73	156.08	.04	70.94	.93	-16.82
.20	.83	-56.61	6.15	138.83	.07	55.92	.82	-29.40
.30	.75	-82.38	5.66	124.38	.09	46.12	.70	-37.28
.40	.70	-104.35	5.08	112.82	.10	39.45	.61	-42.73
.50	.65	-122.97	4.52	102.90	.11	35.38	.54	-45.93
.60	.62	-138.09	4.00	94.98	.11	32.50	.49	-48.61
.70	.60	-150.60	3.57	88.01	.11	30.78	.45	-50.55
.80	.59	-161.35	3.21	82.00	.11	30.02	.42	-52.19
.90	.59	-170.46	2.90	76.74	.12	29.88	.40	-54.08
1.00	.59	-178.60	2.65	71.87	.12	30.03	.38	-55.78
1.10	.59	174.04	2.43	67.34	.12	30.52	.37	-57.60
1.20	.59	167.50	2.25	62.99	.12	31.42	.36	-59.72
1.30	.60	161.38	2.08	59.07	.12	32.31	.35	-61.84
1.40	.60	156.04	1.95	55.38	.13	33.59	.34	-64.46
1.50	.61	150.72	1.82	51.53	.13	34.65	.33	-67.05
1.60	.62	146.09	1.71	48.04	.13	35.76	.33	-70.23
1.70	.63	141.52	1.61	44.61	.14	36.98	.32	-73.46
1.80	.64	137.65	1.53	41.49	.14	38.11	.32	-76.96
1.90	.65	133.69	1.45	38.35	.15	38.91	.32	-80.43
2.00	.66	130.09	1.38	35.44	.15	39.97	.31	-84.11
2.10	.67	126.52	1.32	32.33	.16	40.67	.31	-88.21
2.20	.68	123.26	1.26	29.70	.16	41.25	.31	-92.12
2.30	.69	120.27	1.20	26.91	.17	41.76	.31	-96.67
2.40	.69	117.15	1.15	24.44	.18	42.09	.31	-100.78
2.50	.70	114.27	1.10	21.83	.19	42.08	.31	-105.22
2.60	.71	111.71	1.06	19.60	.19	42.18	.31	-109.89
2.70	.72	109.21	1.02	17.12	.20	42.29	.32	-114.66
2.80	.73	106.70	.97	14.96	.21	41.78	.32	-119.25
2.90	.74	104.47	.94	12.97	.22	41.42	.33	-124.21
3.00	.75	102.28	.91	10.82	.22	41.10	.33	-128.59



**S PARAMETER Q1**

V<sub>CE</sub> = 3 V, I<sub>c</sub> = 5 mA, Z<sub>0</sub> = 50  $\Omega$

FREQUENCY GHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
.10	.84	-37.26	10.52	150.99	.04	67.19	.89	-23.52
.20	.74	-70.72	9.17	131.67	.06	52.38	.72	-38.66
.30	.65	-100.14	7.97	116.47	.07	44.81	.58	-46.62
.40	.60	-122.73	6.76	105.34	.08	41.17	.48	-51.47
.50	.57	-139.98	5.74	96.73	.09	39.62	.42	-54.25
.60	.55	-153.16	4.95	89.92	.09	38.83	.37	-56.48
.70	.54	-163.95	4.33	84.13	.10	38.89	.34	-58.22
.80	.54	-173.01	3.85	78.92	.10	39.22	.31	-59.93
.90	.54	179.14	3.44	74.44	.11	40.21	.30	-61.82
1.00	.54	172.20	3.13	70.19	.11	40.98	.28	-63.63
1.10	.55	165.80	2.86	66.20	.12	41.45	.27	-65.68
1.20	.55	160.12	2.63	62.35	.12	42.12	.26	-68.02
1.30	.56	154.92	2.43	58.82	.13	42.51	.25	-70.57
1.40	.57	150.12	2.27	55.44	.13	43.29	.24	-73.51
1.50	.58	145.43	2.12	51.94	.14	43.44	.23	-76.52
1.60	.59	141.31	1.99	48.73	.15	43.67	.23	-80.31
1.70	.60	137.23	1.88	45.70	.15	44.06	.22	-84.21
1.80	.61	133.70	1.78	42.72	.16	44.00	.22	-88.16
1.90	.62	130.17	1.68	39.69	.16	43.77	.22	-92.09
2.00	.63	126.82	1.60	37.07	.17	43.80	.22	-96.22
2.10	.64	123.64	1.53	34.06	.18	43.62	.22	-101.16
2.20	.65	120.71	1.46	31.55	.18	43.25	.22	-105.74
2.30	.66	117.99	1.40	28.81	.19	42.92	.22	-110.57
2.40	.67	115.08	1.33	26.41	.20	42.38	.22	-115.34
2.50	.68	112.54	1.28	23.75	.21	41.92	.22	-120.22
2.60	.68	110.13	1.23	21.72	.21	41.46	.22	-125.18
2.70	.69	107.78	1.18	19.41	.22	40.69	.23	-130.36
2.80	.70	105.52	1.14	17.04	.23	39.95	.24	-134.71
2.90	.71	103.31	1.10	15.04	.23	39.10	.24	-139.65
3.00	.72	101.25	1.06	12.85	.24	38.40	.25	-144.01

Discontinued Product

S PARAMETER Q1

V<sub>CE</sub> = 3 V, I<sub>c</sub> = 7 mA, Z<sub>0</sub> = 50 Ω

FREQUENCY GHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
.10	.79	-44.32	13.71	146.95	.04	64.19	.84	-28.71
.20	.67	-82.73	11.45	126.15	.05	50.70	.64	-44.98
.30	.59	-113.49	9.41	111.03	.07	45.71	.49	-52.71
.40	.55	-134.72	7.67	100.87	.07	44.09	.40	-57.18
.50	.52	-150.16	6.37	93.24	.08	43.89	.35	-59.82
.60	.52	-161.98	5.44	87.20	.08	44.29	.31	-62.08
.70	.51	-171.56	4.71	81.95	.09	44.90	.28	-63.86
.80	.51	-179.64	4.17	77.28	.10	45.68	.26	-65.85
.90	.52	173.30	3.73	73.14	.10	46.53	.24	-67.95
1.00	.52	167.06	3.38	69.28	.11	47.24	.23	-70.01
1.10	.53	161.26	3.08	65.48	.12	47.44	.22	-72.42
1.20	.54	156.05	2.83	61.95	.12	47.51	.21	-75.34
1.30	.54	151.22	2.61	58.77	.13	47.41	.20	-78.33
1.40	.55	146.81	2.44	55.41	.14	47.76	.19	-81.85
1.50	.56	142.49	2.28	52.20	.14	47.48	.19	-85.78
1.60	.57	138.66	2.14	49.11	.15	47.27	.18	-90.06
1.70	.58	134.85	2.02	46.08	.16	47.00	.18	-94.72
1.80	.59	131.54	1.91	43.25	.17	46.66	.18	-99.13
1.90	.60	128.16	1.81	40.43	.17	45.91	.18	-103.95
2.00	.61	125.10	1.72	37.91	.18	45.50	.18	-108.59
2.10	.62	122.05	1.64	34.92	.19	44.78	.18	-114.11
2.20	.63	119.27	1.57	32.41	.20	44.24	.18	-118.98
2.30	.64	116.70	1.50	29.76	.20	43.38	.18	-124.21
2.40	.65	113.87	1.43	27.41	.21	42.59	.18	-129.50
2.50	.66	111.51	1.37	25.17	.22	41.98	.19	-134.34
2.60	.67	109.16	1.32	22.83	.22	41.02	.19	-139.54
2.70	.68	106.97	1.27	20.70	.23	40.16	.20	-144.26
2.80	.69	104.65	1.22	18.35	.24	39.22	.21	-148.76
2.90	.70	102.63	1.18	16.37	.25	38.29	.22	-153.16
3.00	.71	100.68	1.14	14.21	.25	37.45	.23	-157.18

**S PARAMETER Q2**

V<sub>CE</sub> = 3 V, I<sub>c</sub> = 1 mA, Z<sub>0</sub> = 50 Ω

FREQUENCY GHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
.10	.97	-20.79	2.52	162.21	.04	76.22	.98	-8.81
.20	.93	-40.50	2.43	147.42	.08	63.75	.93	-16.39
.30	.89	-59.73	2.35	134.45	.11	53.38	.87	-22.34
.40	.84	-76.87	2.20	123.37	.13	44.64	.81	-27.24
.50	.80	-93.28	2.11	113.14	.14	38.01	.76	-30.90
.60	.76	-107.72	1.99	104.15	.15	32.06	.71	-34.29
.70	.74	-120.25	1.85	96.02	.16	27.52	.68	-36.96
.80	.71	-131.32	1.74	88.78	.15	24.29	.65	-39.46
.90	.69	-141.35	1.64	82.34	.15	21.95	.62	-41.97
1.00	.68	-150.05	1.53	76.48	.15	20.46	.60	-44.52
1.10	.68	-157.96	1.44	71.18	.15	19.32	.58	-47.14
1.20	.67	-165.04	1.36	66.07	.14	19.44	.57	-50.06
1.30	.67	-171.63	1.29	61.58	.14	20.32	.56	-52.97
1.40	.67	-177.36	1.23	57.26	.13	22.04	.54	-56.38
1.50	.67	176.90	1.17	52.95	.13	24.64	.53	-59.83
1.60	.67	171.98	1.11	49.02	.13	27.93	.52	-63.99
1.70	.68	166.97	1.06	45.23	.13	32.01	.51	-68.26
1.80	.68	162.82	1.02	41.90	.13	35.88	.50	-72.94
1.90	.69	158.53	.98	38.32	.13	39.86	.49	-77.61
2.00	.69	154.69	.94	35.40	.14	44.56	.48	-82.95
2.10	.70	150.93	.91	32.13	.15	48.10	.47	-88.66
2.20	.70	147.32	.88	29.30	.16	51.51	.46	-94.50
2.30	.71	144.13	.84	26.66	.17	53.73	.46	-100.96
2.40	.72	140.81	.81	24.15	.19	54.94	.45	-107.69
2.50	.72	137.73	.79	21.71	.21	55.71	.45	-114.70
2.60	.73	134.85	.76	19.47	.23	55.82	.45	-122.04
2.70	.73	132.23	.74	17.56	.24	55.39	.45	-129.51
2.80	.74	129.37	.72	15.32	.26	54.32	.45	-137.20
2.90	.75	126.78	.69	13.76	.28	53.05	.45	-144.79
3.00	.75	124.46	.68	11.96	.30	51.65	.46	-152.23

Discontinued Product

**S PARAMETER Q2**

$V_{CE} = 3\text{ V}$ ,  $I_c = 3\text{ mA}$ ,  $Z_0 = 50\ \Omega$

FREQUENCY GHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
.10	.90	-29.30	6.71	155.29	.04	71.05	.93	-16.80
.20	.82	-56.11	6.09	137.78	.07	56.98	.81	-28.76
.30	.73	-80.85	5.56	123.40	.09	48.29	.68	-35.65
.40	.67	-101.56	4.95	111.97	.10	42.87	.59	-40.13
.50	.62	-118.49	4.38	102.51	.11	39.94	.52	-42.64
.60	.59	-131.80	3.86	94.93	.11	38.27	.47	-44.51
.70	.57	-142.87	3.44	88.40	.11	37.56	.43	-45.87
.80	.56	-152.14	3.11	82.68	.12	37.77	.40	-47.30
.90	.55	-159.99	2.82	77.69	.12	38.47	.38	-48.65
1.00	.54	-166.88	2.59	73.06	.13	39.41	.36	-50.22
1.10	.54	-173.10	2.39	68.79	.13	40.39	.34	-51.85
1.20	.55	-178.59	2.21	64.68	.13	41.56	.32	-54.00
1.30	.55	176.42	2.07	61.03	.14	42.83	.31	-56.35
1.40	.55	171.90	1.95	57.31	.15	44.25	.29	-59.16
1.50	.56	167.41	1.84	53.63	.15	45.41	.28	-62.05
1.60	.57	163.59	1.74	50.19	.16	46.21	.26	-66.12
1.70	.57	159.71	1.66	46.97	.17	47.04	.25	-70.04
1.80	.58	156.43	1.58	43.76	.18	47.53	.24	-74.96
1.90	.59	153.08	1.51	40.55	.19	47.85	.23	-79.98
2.00	.60	149.93	1.45	37.59	.19	48.39	.22	-85.71
2.10	.60	146.93	1.40	34.56	.21	48.56	.21	-92.39
2.20	.61	144.08	1.34	31.82	.22	48.55	.20	-99.18
2.30	.62	141.48	1.29	28.94	.23	48.56	.19	-107.58
2.40	.63	138.74	1.25	26.22	.24	48.08	.19	-116.23
2.50	.64	136.23	1.20	23.63	.25	47.57	.19	-125.28
2.60	.65	133.79	1.16	20.97	.26	46.88	.19	-134.70
2.70	.66	131.63	1.13	18.63	.28	46.03	.20	-144.38
2.80	.67	129.33	1.09	16.09	.29	45.03	.20	-153.65
2.90	.68	127.06	1.06	14.06	.30	43.72	.22	-162.12
3.00	.68	125.06	1.02	11.49	.31	42.77	.23	-169.77

**S PARAMETER Q2**

V<sub>CE</sub> = 3 V, I<sub>c</sub> = 5 mA, Z<sub>0</sub> = 50  $\Omega$

FREQUENCY GHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
.10	.83	-36.95	10.41	149.93	.04	67.41	.87	-23.15
.20	.72	-69.61	9.00	130.38	.06	54.36	.70	-36.92
.30	.62	-97.36	7.70	115.33	.07	48.48	.56	-43.33
.40	.56	-117.96	6.47	104.59	.08	46.08	.46	-46.73
.50	.53	-133.20	5.47	96.45	.09	45.55	.40	-48.28
.60	.51	-145.02	4.72	89.97	.10	45.75	.35	-49.37
.70	.50	-154.27	4.13	84.56	.10	46.29	.32	-50.23
.80	.49	-162.17	3.68	79.59	.11	47.21	.29	-50.94
.90	.49	-168.79	3.31	75.30	.12	48.13	.27	-51.90
1.00	.49	-174.60	3.02	71.24	.13	48.87	.25	-53.05
1.10	.49	-179.99	2.77	67.35	.13	49.47	.23	-54.36
1.20	.50	175.37	2.56	63.72	.14	49.97	.22	-56.22
1.30	.50	170.99	2.38	60.38	.15	50.55	.20	-58.24
1.40	.51	167.14	2.25	57.00	.16	50.91	.19	-61.34
1.50	.52	163.26	2.11	53.63	.17	50.87	.18	-64.21
1.60	.52	159.95	1.99	50.49	.18	50.85	.16	-68.73
1.70	.53	156.57	1.90	47.43	.19	50.65	.15	-73.44
1.80	.54	153.53	1.80	44.40	.20	50.10	.14	-79.56
1.90	.55	150.58	1.72	41.65	.21	49.55	.12	-86.25
2.00	.56	147.71	1.65	38.70	.22	49.28	.11	-94.06
2.10	.57	144.98	1.59	35.74	.23	48.70	.11	-104.12
2.20	.58	142.44	1.53	32.92	.24	47.88	.10	-114.99
2.30	.59	140.07	1.47	30.23	.25	47.17	.10	-127.57
2.40	.60	137.58	1.41	27.68	.26	46.25	.10	-141.02
2.50	.61	135.31	1.36	25.02	.27	45.44	.11	-153.25
2.60	.62	133.07	1.31	22.56	.28	44.32	.12	-164.94
2.70	.63	131.02	1.28	20.38	.29	43.24	.13	-174.58
2.80	.64	128.83	1.23	17.84	.30	41.94	.14	176.60
2.90	.65	126.81	1.20	15.67	.31	40.75	.16	170.26
3.00	.66	124.98	1.16	13.38	.32	39.42	.18	163.89

Discontinued Product

**S PARAMETER Q2**

$V_{CE} = 3\text{ V}$ ,  $I_c = 7\text{ mA}$ ,  $Z_0 = 50\ \Omega$

FREQUENCY GHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
.10	.78	-43.98	13.56	145.65	.04	65.30	.83	-28.08
.20	.64	-81.06	11.15	124.63	.05	53.73	.62	-42.31
.30	.55	-109.37	9.00	109.90	.07	50.12	.47	-48.09
.40	.50	-128.61	7.29	100.27	.07	49.49	.39	-50.66
.50	.48	-142.36	6.05	93.07	.08	50.25	.33	-51.72
.60	.47	-152.78	5.16	87.38	.09	50.94	.29	-52.25
.70	.46	-161.04	4.49	82.41	.10	51.76	.26	-52.80
.80	.46	-168.03	3.98	77.92	.11	52.62	.23	-53.35
.90	.46	-173.82	3.57	74.02	.12	53.24	.21	-54.00
1.00	.46	-179.09	3.24	70.24	.13	53.84	.19	-55.03
1.10	.47	176.20	2.97	66.63	.14	53.96	.18	-56.17
1.20	.47	171.98	2.75	63.22	.15	53.97	.16	-58.07
1.30	.48	168.07	2.55	60.08	.16	53.98	.15	-60.12
1.40	.49	164.50	2.40	56.83	.17	53.80	.14	-63.36
1.50	.50	160.99	2.25	53.72	.18	53.24	.12	-66.67
1.60	.50	157.91	2.13	50.70	.19	52.57	.11	-72.24
1.70	.51	154.69	2.02	47.63	.20	52.05	.09	-78.75
1.80	.52	151.94	1.92	44.73	.21	51.25	.08	-87.51
1.90	.53	149.12	1.83	41.86	.22	50.40	.07	-97.71
2.00	.54	146.49	1.75	39.20	.23	49.60	.07	-110.79
2.10	.55	143.89	1.68	36.30	.24	48.74	.06	-127.63
2.20	.56	141.54	1.62	33.80	.25	47.70	.06	-144.64
2.30	.57	139.30	1.55	31.21	.26	46.78	.07	-160.83
2.40	.58	136.93	1.50	28.56	.27	45.56	.08	-175.36
2.50	.59	134.74	1.44	26.11	.28	44.37	.09	174.41
2.60	.60	132.62	1.39	23.72	.29	43.25	.11	166.38
2.70	.61	130.60	1.35	21.44	.30	41.87	.13	159.99
2.80	.62	128.48	1.31	18.83	.31	40.71	.14	154.42
2.90	.63	126.53	1.27	16.82	.32	39.19	.16	150.20
3.00	.64	124.73	1.23	14.52	.33	38.05	.18	146.24

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